GRAINS RESEARCH UPDATE

BOOSTING PROFITABILITY – RESILIENT SOLUTIONS

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

Hopetoun

Thursday 14 March

9.00am to 1.00pm

Hopetoun Memorial Hall,

14 Austin Street, Hopetoun

#GRDCUpdates

Hopetoun GRDC Grains Research Update
convened by ORM Pty Ltd.

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SOUTHERN/WESTERN REGION*

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Potential high-risk paddocks:

- Bare patches, uneven growth, white heads in previous crop
- Paddocks with unexplained poor yield from the previous year
- High frequency of root lesion nematode-susceptible crops, such as chickpeas
- Intolerant cereal varieties grown on stored moisture
- Newly purchased or leased land
- Cereals on cereals
- Cereal following grassy pastures
- Durum crops (crown rot)

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- Crown rot (cereals)
- Rhizoctonia root rot
- Take-all (including oat strain)
- Root lesion nematodes
- Cereal cyst nematode
- Stem nematode
- Blackspot (field peas)
- Yellow leaf spot
- Common root rot
- Pythium clade f
- Charcoal rot
- Ascochyta blight of chickpea
- White grain disorder
- Sclerotinia stem rot

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Program

9:00 am	**Welcome**	***Brett Symes,*** *ORM*
9:05 am	**GRDC welcome and update**	***GRDC representative***
9:15 am	**The war on weeds- latest tips**	***Chris Preston,*** *University of Adelaide*
9:55 am	**Hay – how is it 'stacking up'?**	***Colin Peace,*** *Jumbuk Ag Consulting*
10:35 am	***Morning tea***	
11.05 am	**Cost-effective solutions for ameliorating sandy soils**	***Rick Llewellyn,*** *CSIRO*
11:45 am	**The crop doctor – 'don't be fooled by the dry conditions'**	***Grant Hollaway,*** *Agriculture Victoria*
12.25 pm	**Putting it all together for the 2019 cropping season**	***Simon Craig,*** *Agronomise*
1.05 pm	***Close and evaluation***	***Brett Symes,*** *ORM*
1.10 pm	**Lunch**	

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The GRDC's **Farming the Business** manual is for farmers and advisers to improve their farm business management skills.

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- **Module 3: How do I take my business to the next level?**

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Celebrating Twenty One years of Mallee Sustainable Farming

The millennium and 1982 droughts were devastating for Mallee farmers, with harvest for the most part a non-event. However, in the midst of yet another drought, the region's farmers have this year found successes to celebrate: 2018 has still seen some production across much of the Mallee, thanks in part to the work local farmers have put in over more than two decades in partnership with Mallee Sustainable Farming.

For 21 years Mallee Sustainable Farming (MSF) has remained a proudly farmer-led organization, aiming to boost agricultural productivity and profit and support farmers in the tristate Mallee region by conducting research, development and extension in the latest farming practices.

Over two decades MSF has stayed true to its charter to connect researchers and advisers from leading organisations with Mallee farmers for region-specific on-farm research, trials and education programs.

"This year has seen decile 1 rainfall conditions across the Mallee from northern NSW to more southern areas of South Australia and Victoria," says MSF Executive Chair and Trentham Cliffs farmer Daniel Linklater.

"Comparing this year to the droughts of 1982 and 2002, MSF is proud to have played a significant role in changing the landscape for the better with a reduction in soil erosion and farmers in many cases still able to achieve some crop production.

"The Mallee was a place once known for heat and dust. These days that dust now remains safely locked into productive paddocks, thanks in large measure to MSF's work in advancing, proving and promoting the advantages of improved farming systems, starting largely with the adoption of no-till."

Some of the highlights of the past 21 years include:

- The widespread introduction and adoption of no-till and stubble retention farming techniques
- Establishment of core research sites at:
  - Allen Buckley's Waikerie property
  - Peter and Hannah Loller's Karoonda property
  - Jim Maynard's 'Kerribee' near Gol Gol
  - Matt Curtis's Merbein property
  - Robin Shaefer's 'Bulla Burra' at Loxton
  - Ian Hastings' Ouyen property
- Trials across 46 Farmer Focus paddocks hosted by farmers across the region
- Educating thousands of farmers at MSF Field Days
- Hundreds of in depth local research projects into areas such as rotations, nutrition, soil microbiology, soil water, agronomy, tillage and protein
- The Strengthening Our Communities project to increase access to farmer support systems and build morale in drought-affected rural communities during the millenium drought.

To celebrate the first 21 years of MSF the organisation has launched a commemorative magazine: *TwentyOne: The First 21 Years of Mallee Sustainable Farming*. The 94-page publication includes interviews with farmers, researchers and MSF volunteers; historical photos; and highlights of the past 21 years, and sets a course for where the next 21 years may take the MSF and agriculture in the region.

"Even though this is a drought year, this is an important opportunity for us to celebrate how far we've come and increase awareness of our work with the aim of benefiting even more farming families," Mr Linklater says.

"The true heroes of this story are our local farmers, whose open-mindedness to taking risks and trying new things have allowed for the radical changes we have seen.

"Current MSF work examining best management of sandy soils, seeps, pastures and livestock and frost will continue to develop improved farming practices through farmer driven collaboration with researchers and advisers.

"Together we are literally changing the landscape and the face of farming in the Mallee."

Copies of *TwentyOne: The First 21 Years of Mallee Sustainable Farming* have been sent to the Prime Minister, Agriculture Minister and other federal, state and local MPs as an example of a best-practice grassroots program supporting farmers to be self-reliant in a dry climate. It's also hoped seeing what has been achieved over the past 21 years will encourage the government's continued resourcing of agricultural research and extension projects by Mallee Sustainable Farming and other organisations.

The magazine was previewed at the MSF AGM in Mildura on 17 October and is now being distributed to Mallee Sustainable Farming subscribers.
To register for a free downloadable copy, visit **http://www.msfp.org.au/twentyone**

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- **Access** trials data and reports from across Australia
- **Share** your grains research online
- **View** seasonally relevant collections of trials
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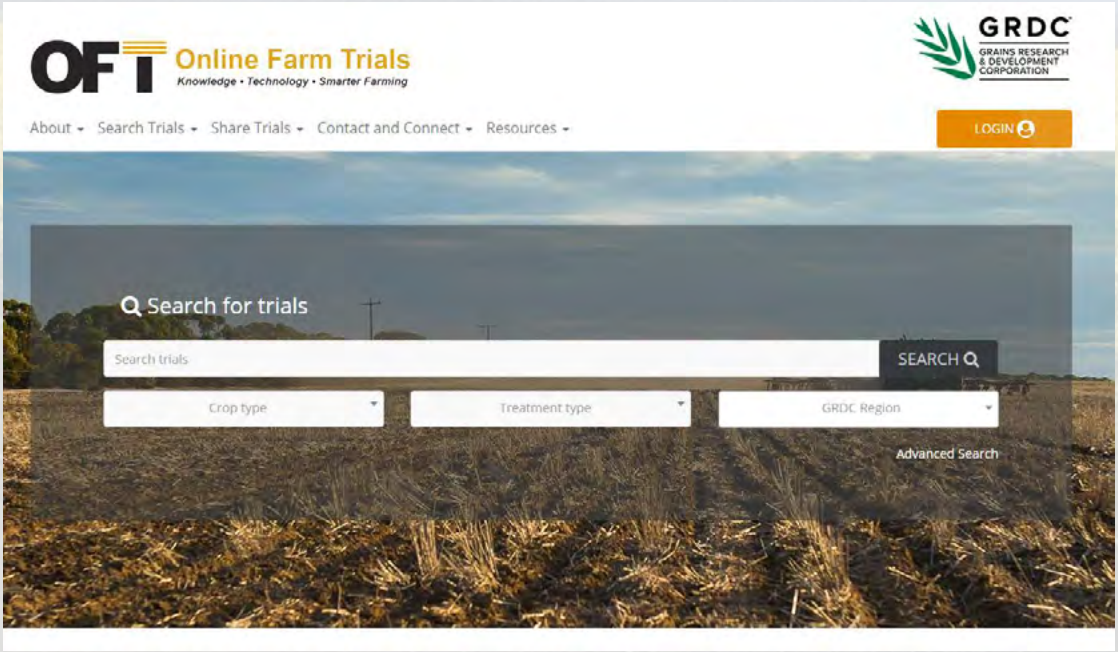
- **Refer** to location specific soil and climate data
- **Compare** results from multiple trials to identify trends

Looking for relevant and freely accessible information on issues such as crop nutrition, disease control or stubble management in your region? Online Farm Trials (OFT) contains more than 6000 trial projects, 80% of which are publically available, from across Australia on a wide variety of crop management issues and methods. Use OFT to discover relevant trial research information and result data, and to share your grains research online.



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The war on weeds- latest tips

Christopher Preston, Peter Boutsalis, Sam Kleemann and Gurjeet Gill.

School of Agriculture, Food & Wine, University of Adelaide.

GRDC project codes: UCS00020, UA00124

Keywords

- herbicide resistance, brome grass, annual ryegrass, glyphosate resistance, fence line weed control.

Take home messages

- Brome grass has resistance to Group A and Group B sulfonylurea herbicides in the Mallee, but Intervix® is still effective.
- Two years of excellent control of brome grass seed set is required to run down seed banks.
- Uragan® or Terrain® are useful alternatives to glyphosate for controlling weeds on fence lines.

Resistance to herbicides in the Mallee and Wimmera

The Wimmera and Mallee were last surveyed for herbicide resistance in 2015. For annual ryegrass, resistance to trifluralin, Intervix® and glyphosate had all increased, but there was little resistance to the new pre-emergent herbicides Boxer Gold® and Sakura® (Table 1). Glyphosate resistance was low in both areas but is now common enough to be picked up in our random weed surveys.

For brome grass, resistance was found to the Group A and Group B herbicides (Table 2). All of the resistant populations were from the Mallee. While resistance to the Group B sulfonylurea herbicides was present, no resistance to Intervix® was found.

Integrated management of brome grass

Integrated management of brome grass is much more difficult than integrated management of annual ryegrass. Imidazolinone herbicides, such as Intervix®

Table 1. Extent of herbicide resistance in annual ryegrass collected in random surveys in Wimmera and Mallee in 2015. Populations are considered resistant if there is more than 20% survival.

Herbicides tested	Group	Annual ryegrass populations resistant (%)	
		Wimmera	Mallee
Trifluralin	D	36	23
Boxer Gold®	J + K	0	0
Sakura®	K	0	0
Propyzamide	D	0	0
Hoegrass®	A	80	47
Oust®	B	53	68
Intervix®	B	21	44
Axial®	A	46	10
Select®	A	10	0
Glyphosate	M	9	3

Table 2. Extent of herbicide resistance in brome grass collected in random surveys in Wimmera and Mallee in 2015. Populations are considered resistant if there is more than 20% survival.

Herbicides tested	Group	Brome grass populations resistant (%)
Targa®	A	8
Atlantis®	B	12
Intervix®	B	0
Glyphosate	M	0

Table 3. Herbicide strategies investigated for the management of brome in lupins, triazine tolerant (TT)-canola, wheat and barley at Balaklava (2014-2016).

*Cropping phase	Herbicide strategy (1 & 2)	
	HS1	HS2
Lupins	Simazine pre	Simazine pre
	Haloxyfop post	Haloxyfop post
		Paraquat crop-top
TT-canola	Atrazine pre	Propyzamide pre
	Atrazine plus Haloxyfop post	Atrazine plus Haloxyfop post
		Glyphosate crop-top
Wheat	Trifluralin pre	Sakura® plus Avadex® Xtra pre
	Intervix® post	Glyphosate crop-top
Barley	Trifluralin plus metribuzin pre	Trifluralin pre
		Intervix® post

**Wheat and barley cultivars are tolerant to imidazolinone herbicides.*

remain the best herbicide options available for brome grass; however, they are Group B herbicides and at high risk of resistance. A trial was conducted of integrated management strategies for brome grass at Balaklava in SA over the past 2014-2016 seasons. The trial consisted of four crop options in rotation with two strategies in each of the crops (Table 3). Clearfield® options were used for the cereal phase of the rotation.

The two break crops in the rotation were able to reduce the brome grass seed bank, regardless of the strategy used. However, for cereals the brome grass seed bank was only reduced when Clearfield® crops and Intervix® herbicide were used (Figure 1). Previous research has demonstrated that you need two consecutive years of good control of brome grass to manage this weed species. Back to back break crops (lupins followed by canola) followed by a Clearfield® cereal, reduced brome grass seed production in 2015 to 0. Clearly it is important to use the last remaining Intervix® applications on brome grass in the cereal part of the rotation that follows a break crop to achieve the best long-term result.

Management of glyphosate resistant weeds on fence lines

Glyphosate resistant weeds occurring on fence lines and crop margins can cause problems by moving into the cropped areas. Fence lines suffer from having no competition, so any surviving weed has full access to resources and can set a lot of seed. There are several species with glyphosate-resistance that can become problems in this area including annual ryegrass, windmill grass, brome grass and fleabane. Some years ago, research was conducted on the management of glyphosate resistant annual ryegrass on fence lines that led to the registration of Uragan® for this purpose. There are some other options that can be used during spring, but they tend not to work as well (Table 4). One of the problems with controlling all vegetation on fence lines is that they can become open to wind erosion on light soils if they are continually kept bare. Sowing as close as possible to the fence can reduce the amount of soil exposed.

An alternative to Uragan® that has been registered since our work was conducted on annual ryegrass is Terrain®. Terrain® needs to be applied to bare ground and needs 15mm of rain within a few weeks to activate it, consequently autumn or winter applications will be most effective. Terrain® is a good choice where young trees are close to the fence line.

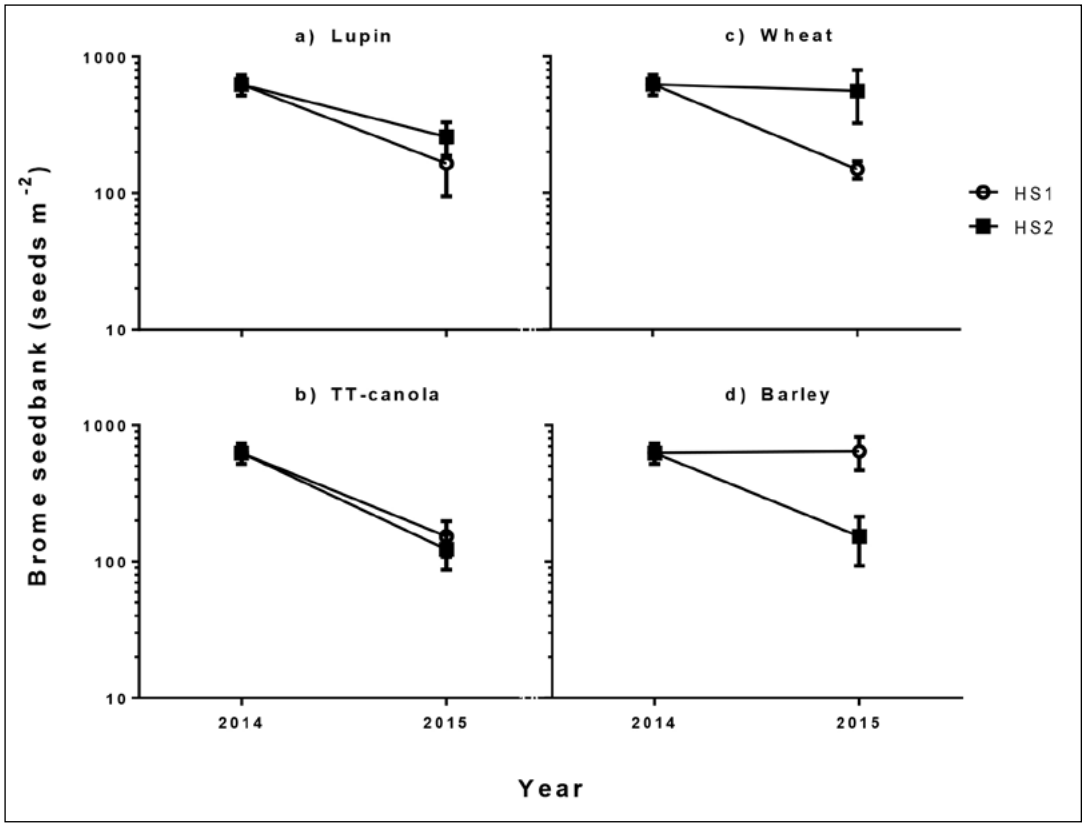

Figure 1. Change in brome grass seed bank in response to herbicide strategy (HS1 and HS2) in (a) lupin (b) TT-canola (c) wheat and (d) barley crop phases at Balaklava in 2015. Detailed description of herbicide strategies is presented in Table 3. Vertical bars represent standard errors. The initial brome grass seed bank was 626 seeds/m^2.

Table 4. Control of glyphosate-resistant annual ryegrass on fence lines with alternative herbicides at Hilltown and Ungarra in 2011.

Treatment	Rate (g or L/ha[1])	Hilltown		Ungarra	
		Seed heads* (per m^2)	Seed head reduction (%)	Seed heads* (per m^2)	Seed head reduction (%)
Untreated	-	1111 a	0	271 a	0
Glyphosate 540g/L	1L	1002 ab	10	78 ab	71
Glyphosate 540 g/L	2L	919 ab	17	61 ab	77
Glyphosate 540g/L + (amitrole 250g/L + ammonium thiocyanate 220 g/L)	1L + 6L	367 bc	67	86 ab	68
Glyphosate 540g/L + bromacil 800 g/kg	1L + 3kg	433 bc	61	58 ab	79
Paraquat 135g/L + diquat 115g/L	3.2L	172 bc	85	3 b	99
Paraquat 125g/L + amitrole 250g/L	4L	76 cd	93	3 b	99
[Paraquat 135g/L + diquat 115g/L] + bromacil 800g/kg	3.2L + 3kg#	0 e	100	3 b	99
Glufosinate 200g/L + (amitrole 250g/L + ammonium thiocyanate 220g/L)	6L + 6L	138 cd	88	1 b	99.5
Glufosinate 200g/L + bromacil 800g/kg	6L + 3kg#	0 e	100	0 b	100
[Paraquat 135g/L + diquat 115g] fb [Paraquat 135g/L + diquat 115g]	3.2L fb 3.2L	27 d	98	3 b	99

Note: fb = followed by
Bromacil (Uragan) label rate for non-crop areas is 3.5 to 6.5kg/ha, with the 2.0 to 6.5kg/ha rate on the label for "retreatment'

Useful resources

https://grdc.com.au/resources-and-publications/groundcover/ground-cover-supplements/groundcover-issue-128-weeds/new-options-for-southern-fenceline-weed-control

Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support.

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SPRAY APPLICATION GROWNOTES™ MANUAL

SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

The Spray Application GrowNotes™ Manual is a comprehensive digital publication containing all the information a spray operator needs to know when it comes to using spray application technology.

It explains how various spraying systems and components work, along with those factors that the operator should consider to ensure the sprayer is operating to its full potential.

This new manual focuses on issues that will assist in maintaining the accuracy of the sprayer output while improving the efficiency and safety of spraying operations. It contains many useful tips for growers and spray operators and includes practical information – backed by science – on sprayer set-up, including self-propelled sprayers, new tools for determining sprayer outputs, advice for assessing spray coverage in the field, improving droplet capture by the target, drift-reducing equipment and techniques, the effects of adjuvant and nozzle type on drift potential, and surface temperature inversion research.

It comprises 23 modules accompanied by a series of videos which deliver 'how-to' advice to growers and spray operators in a visual easy-to-digest manner. Lead author and editor is Bill Gordon and other contributors include key industry players from Australia and overseas.

Spray Application GrowNotes™ Manual – go to: https://grdc.com.au/Resources/GrowNotes-technical Also go to https://grdc.com.au/Resources/GrowNotes and check out the latest versions of the Regional Agronomy Crop GrowNotes™ titles.

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Hay – how is it 'stacking up'?

Colin Peace.

Jumbuk Ag Consulting.

Keywords

- hay, export oaten, drought.

Take home messages

- Domestic and export demand for hay remain solid in short term.
- Export prices are matching those of domestic drought demand.
- Suggest accessing export oaten hay market with a new crop contract.

Background

Hay in the rotation benefits future grain crops and is an option for many in difficult seasons. 2018 has seen large areas of cereal and canola crops cut for hay, much of which currently remains for sale on-farm. Hay prices are high but can change rapidly according to weather patterns. Hay marketing is also very different to grain, requiring new relationships and patience.

Method

Through analysis of the Australian Bureau of Statistics (ABS) and conversations with contractors and hay growers, the hay supply and demand for the 2018 season has been undertaken and some conclusions drawn.

Figure 1. Price for hay delivered on-farm ($/t) from 1999 to 2019.

Results and discussion

Prices

2018 saw hay prices reach record levels due to the extended drought down the east coast of Australia. Although the current prices have eased by approximately $40/t, prices are well supported.

Supply

The 2018 hay and silage season saw a surprisingly large volume of hay baled. Around 15% of the area sown to wheat and barley in Victoria was cut for hay, albeit at low yields. The other key issue for supply was the impact of the mid December rain on the pastures in Gippsland and Western Districts. These areas enjoyed extended grazing on green pastures and subsequent generous volumes of hay and silage (Figure 2).

Demand

The 2018 demand for hay ramped up in April last year with graziers from NSW and Qld buying up carryover hay. This demand continues this year and the extended road train network in Victoria is helping the huge northern-bound freight task.

The eight export plants in the Victorian region have been actively competing with the local market and export volumes have been maintained. Chinese demand continues to remain strong (Figure 3).

Quality

As often happens with droughted cereal hay, the quality of hay has been well above average.

Although the canola crops, first cut in early to mid-flower, were testing at 17 to 19% protein, the average for the season has been similar to that during the

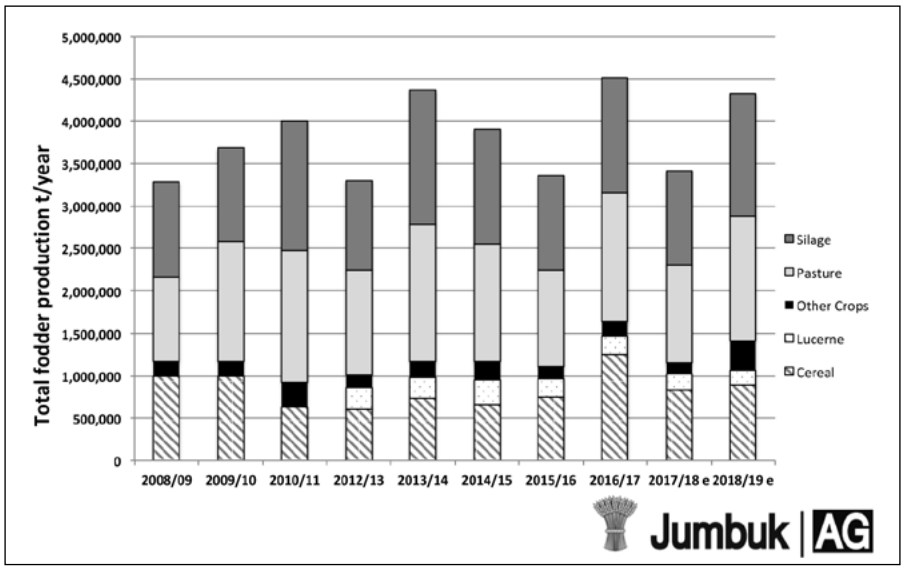

Figure 2. Historical hay production in Victoria (ABS) and estimates for 2018/19 (Jumbuk Ag).

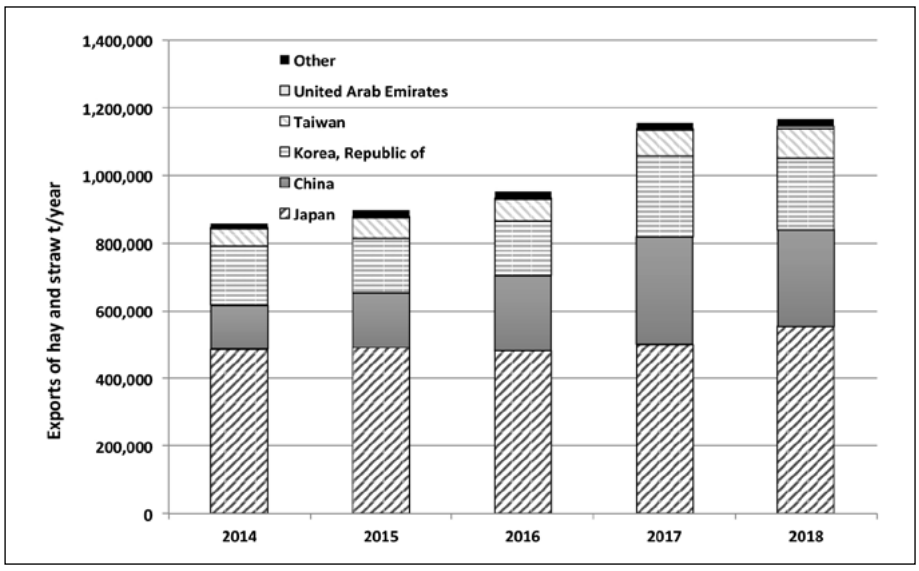

Figure 3. Historical exports of Australian hay and straw (Source: ABS).

Table 1. Comparative quality of hay samples analysed in the first three months of the season.

Hay type	Year	No. of Samples		Crude Protein (%)	Energy ME (MJ/kg DM)	NDF (%)
Canola	2006	579	Avg	15.9	9.8	41.3
				4.0-27.2	4.1-13.1	25.4-77.8
Canola	2018	579	Avg	14.7	9.5	42.5
				3.7-26	3.5-12.8	27-66.4
Wheaten	2016	160	Avg	6.8	8.1	59.0
Wheaten	2018	611	Avg	10.4	10.0	50.8

(Source: FeedTest Werribee)

drought of 2006. As volumes of hay are generous and quality of hay highly variable (particularly for canola hay) buyers are selecting hay on test results.

Monitoring hay stacks for the smell of tobacco, the appearance of slumping bales and by using hot meal probes (i.e. hay moisture meters) is proving valuable to avoid spontaneous combustion. Hay additives are also proving popular to help reduce the oxygen in baled hay, avoid quality losses of heated bales and minimise the chances of fire.

Marketing

Summer demand for protein hay has been increasing, particularly as vetch hay supply is greatly reduced this year and most irrigators are no longer watering their lucerne stands. The cost of grain, hay and water is crippling the dairy industry and cows are being culled from the Murray and Goulburn Valleys and moved to southern Victoria. Buyers are assessing hay with even more scrutiny than previous years.

Access to export markets and shed storage will be essential for those growers who intend to maintain cereal hay in the rotations. Current indications are that a guaranteed minimum price for top grade export oaten hay for the 2019/20 season will be around $250 a tonne delivered to local hay processor plus storage and freight allowances if appropriate.

Following the opening of the new hay processor at Ultima, two new hay plants are expected to be commissioned this year at Raywood and St Arnaud.

Table 2. Example of quality implications of two lots of canola hay competing for a market.

Location	Top price	Bottom price
Storage	Shedded	Paddock stacked
Ex farm price $/t	$330	$230
Bale weight kg	640	580
Protein CP (%)	20%	12%
Energy Mj ME/kg DM	12	6
Dry matter content	90%	85%
B Double payload t	26.24	23.78
Freight paid $/t	$50.59	$55.82
Price del GV Vic	$381	$286
Protein cost $/CP%	$2.11	$2.80
Protein comparison	100%	133%
Energy cost cents/MJ	$0.035	$0.056
Energy comparison	100%	159%

Table 3. Typical gross margins for broadacre crops in 2019/20 harvest period.

	Yield	Price 19/20	Delivery point	Breakeven price	Gross Margin	BE: Forecast Price
Wheat APW	2.46	$335	Geelong port	$154.82	$443.56	46%
Barley Feed	2.41	$280	Geelong port	$147.12	$320.42	53%
Barley Malt	2.41	$300	Melbourne	$166.25	$322.52	55%
Canola	1.64	$550	Geelong port	$288.48	$428.23	52%
Oats milling	2.23	$337	Melbourne	$135.55	$449.90	40%
Chickpea desi	1.34	$630	Melbourne	$293.10	$451.66	47%
Field pea	1.35	$380	Melbourne	$215.29	$222.20	57%
Lentil nugget	1.31	$520	Melbourne	$235.73	$371.70	45%
Faba beans	1.4	$350	Melbourne	$232.70	$164.21	66%
Oaten Hay	5.2	$250	Plant	$112.03	$717.43	45%

Conclusions

Factors that could maintain the current high hay prices:

- Very low carry in hay stocks.
- NSW/Qld demand started earlier this year.
- Still need a break next autumn.
- Mallee vetch all but gone.
- New road train routes encourage buyers.
- Irrigators pulling out of lucerne

Factors that could pull prices down include:

- Dairy herd culled.
- Big hay and silage season in the south.
- Price encourages straw production.
- More cereal crops cut this year.
- NSW demand unlikely to be as large.

Useful resources

https://www.feedtest.com.au/index.php/about/feedtest-information

https://grdc.com.au/resources-and-publications/all-publications/publications/2018/farm-gross-margin-and-enterprise-planning-guide-2018

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Underperforming sandy soils – targeting constraints for cost effective amelioration

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GRDC project code: CSP00203

Keywords

- sands, compaction, non-wetting, crop nutrition, ripping, spading, deep cultivation.

Take home messages

- Know the water limited yield potential and target the soil constraints to crop water-use: Assessing the yield gap relative to expected gains and seasonal risks, alongside identifying the key soil constraints, are important in developing an amelioration plan with cost effective outcomes.
- Yield responses to physical disruption are common but not guaranteed: Considering the depth and severity of compaction, any co-occurring constraints, and machinery specific impacts on soil strength offer an opportunity to optimise decisions for cost effective outcomes.
- Yield responses to increasing fertility at depth (i.e. deep placement/incorporation) are highly dependent on seasonal conditions with risks of neutral or negative yield responses in dry years. Depth of placement and form of nutrition (fertiliser, chicken litter, plant biomass) offer potential to manage nutrient carryover and crop growth responses over multiple years.
- Long term effects are essential for cost effective amelioration outcomes. Economic analysis of long-term trials (five years) has highlighted the importance of seasonal and crop sequence response effects on the cost benefit outcomes.

Background

Crop water use and productivity on sandy soils are commonly limited by a range of co-occurring soil constraints that limit root growth. Constraints include non-wetting behaviour and poor crop establishment; soil pH issues associated with acidity or alkalinity; a low ability to supply and retain nutrients; a natural tendency to compact or form hard-setting layers, and in some cases, subsoil sodicity and/or toxicities. There are opportunities to improve crop water use through optimising annual and low cost mitigation practices (e.g. seeding strategies, wetting agents, fertiliser placement) or through investing in more intensive and expensive soil profile amelioration approaches (deep ripping, spading, deep ploughing). In the low to medium rainfall zone of the Southern Region, it is important to consider the yield potential boundaries, seasonal risks, and the specific co-occurring constraints when developing an amelioration plan. The GRDC Sandy Soils Program (CSP00203) aims to improve the diagnosis and management of underperforming sandy soil in the Southern Region.

Research activities include:

- Understanding the potential for yield gains through improved estimates of the yield gap and associated physical, chemical and biological constraints in sandy soils across the region.

- Monitoring a range of existing long-term trials to assess the five-year impact of a range of amelioration strategies (ripping, spading) with/without amendments (clay, fertiliser, manure, crop biomass).
- Evaluating amelioration and mitigation approaches to improve crop water use and productivity where physical and nutritional constraints dominate, and where these co-occur with water repellence and/or acidity.
- Optimising amelioration approaches through understanding how machinery set-up can influence the impact on the soil profile, and strategies to manage seeding depth control and minimise erosion (e.g. one-pass spader-seeding).
- Assessing cost-benefit outcomes of a range of treatments through economic and risk analysis, and supporting decision making by prioritising the underlying soil constraints.

Methods

Characterisation of soil constraints

A range of physical, chemical and biological analyses have been conducted at core research trial sites to evaluate and describe the soil constraints present, the plant available water capacity, and improve our estimates of the yield gap in sandy soils of the Southern Region.

Research trials

Core project trials across the Southern Region include four long term amelioration sites (established 2014/2015), and seven new research sites (established 2017/2018) that include mitigation and amelioration treatments. Experimental details of the long term PIRSA spading trials (http://www.pir.sa.gov.au/__data/assets/pdf_file/0008/297719/PIRSA_New_Horizons_Trial_Sites_Summary_2017.pdf) and Trengove ripping trial (Trengove and Sherriff, 2018) have been described previously. These trial sites (Karoonda, Brimpton Lake, Cadgee and Bute) have been monitored for 4-5 years for ongoing yield effects, allowing the assessment of the percentage return on investment (marginal return/total costs*100) for a range of amelioration strategies.

New experiments targeted the dominant soil constraints evident at sites – physical and nutritional constraints alone (Waikerie, Carwarp, Bute, Ouyen) or in combination with water-repellence (Murlong, Lameroo) or acidity (Yenda). A summary of amelioration, amendment and placement treatments is provided in Table 1.

Amelioration experiments established in 2018 at Waikerie, Carwarp and Bute aim to evaluate whether increasing amelioration depth and/or nutrient supply within the profile results in cost effective outcomes. The Ouyen trial established in 2017 aims to evaluate the incorporation of farm grown biomasses (vetch hay, oaten hay), with comparison to other amendments (chicken litter, complex carbon compost) on profile nutrition, crop productivity, and the nitrogen (N) balance over multiple years (Moodie and Macdonald, 2018).

Addressing the management of severe water repellence, the 2018 Murlong site includes contrasting amelioration approaches (spading versus topsoil slotting i.e. inclusion plates ± N-rich biomass) alongside mitigation strategies evaluating wetting agent type and placement and furrow management. With acidity a common issue in NSW sandy soils, the Yenda amelioration experiment aims to evaluate deep 'sweep' cultivation (30cm) with/without amendments (urea, lime, 3-9t/ha chicken litter) to shatter and ameliorate a hostile layer approximately 15cm deep (Haskins et al., 2018).

Table 1. Summary of project amelioration trials indicating the type of physical amelioration approach, amendments used and placement strategy.

Site (Yr Est)	Physical amelioration* and depth (cm)	Amendment type#	Placement^
Waikerie (2018)	Rip 30, Rip 60	Chicken litter (2.5t/ha); fertiliser matched	deep, surface
Carwarp (2018)	Spaded 30, Rip 30, Rip 60	High-N biomass (6t/ha)	deep
Bute (2018)	Rip 30, Rip 50, TSSlot 50	Chicken litter (2.5-7.5t/ha)	deep, surface
Ouyen (2017)	Spaded 30, Rip 30	Crop biomasses (6t/ha), chicken litter, compost, fertiliser matched	incorporated, deep
Murlong (2018)	Spaded 30, TTSlot 30, TTSlot 40	High-N biomass (5t/ha); fertiliser	incorporated
Yenda (2017)	Sweep 30, Rip 30	Chicken litter (3-9t/ha)	incorporated

** including ripping (Rip), spading (Spade), topsoil slotting (TSSlot: ripping with inclusions plates), and sweep-cultivation (Sweep), with depth (cm) indicated. # amendments used vary depending on regional availability, where chicken litter is considered unavailable in the VIC Mallee and Eyre Peninsula. ^ placement of amendments includes 'surface' applied (no intervention), 'incorporated' through Spade and/or TSSlot, or actively placed at a controlled rate at the specified target depth.*

Results and discussion

Know the potential and target the constraints to crop water use

Estimates of the yield gap across sandy soil sites in the Southern Region vary from 2-3t/ha where growing season (GS) rainfall is less than 300mm (Table 2). The yield gap is based on an estimate of the yield potential for wheat in an average season minus the current attainable yield based on grower data. The estimated yield gap provides important information when developing an amelioration plan, helping to highlight the limits of productivity within the context of rainfall, and local knowledge of gains that can be achieved through annual strategies (e.g. fertiliser management, change in crop sequence). Further characterisation will refine the yield gap estimates taking into account the plant available water capacity measured at trial sites.

The selected trial sites reflect the prevalence of water repellence in the sands of SA, with lower occurrence of this constraint in Victorian and NSW Mallee soils (Table 2). Measurements of soil strength indicate that moderate constraints to root growth (1.5-2.5 MPa) are reached within 20cm, and severe physical constraints (2.5-3.5 MPa) are common

Table 2. Characteristics of Sandy Soils Experimental Sites; including estimates of the potential yield, current attainable yield and the yield gaps for an average growing season (GS, April-October). Rating of water repellence (top 5cm, based on molar ethanol drop) and soil strength (top 30cm, based on penetration resistance).

Site Location		Estimated Yields			Select constraint ratings	
	GS Rain (mm)	Potential Yield (t/ha)	Current attainable Yield	Yield Gap (t/ha)	Repellence	Soil strength (30cm)
Waikerie	157	2.9	1.0	1.9	Low	Severe
Carwarp	174	3.5	1.0	2.5	0	Severe
Ouyen	213	4.5	1.5	3	0	Severe
Karoonda	235	5	1.5	3.5	Moderate	Moderate
Murlong	251	5.2	1.5	3.7	Severe	TBD
Yenda	252	5.8	2.5	3.3	0	Severe
Lameroo	270	5.9	2.5	3.4	Moderate	Moderate
Bute	298	6.5	3.5	3	Low	Moderate
Brimpton	377	8.3	3.0	5.3	Moderate	TBD
Cadgee	410	9.5	1.3	8.2	Severe	TBD

** Potential Yield = ((0.25 x follow rainfall)+ GSR – 60)*22*1.12. Repellence rating is based on molar ethanol drop (MED) testing of 0-5cm and 5-10cm soil samples. Soil strength rating is based on assessing penetration resistance within the top 30cm, where 1.5-2.5 MPa = moderate, 2.5-3.5 = strong, and >3.5 = severe.*

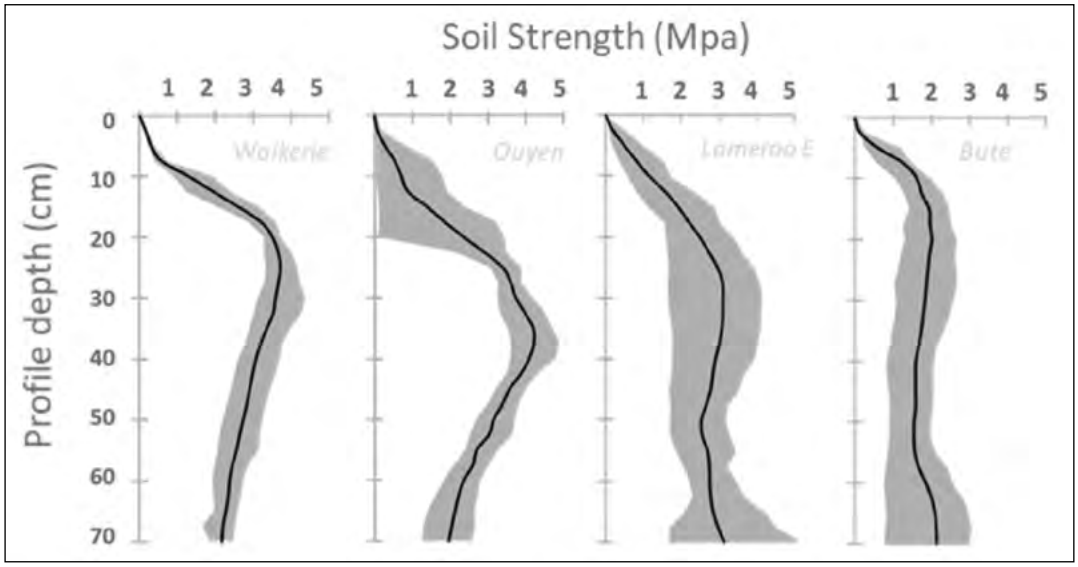

Figure 1. Examples of the variation in severity and depth of penetration resistance (MPa) in a range of sandy soil trial sites across the Southern Region. The black line indicates the site average, with grey shading indicating minimum and maximum readings across six measurements. Soil strength 1.5-2.5 MPa = moderate, 2.5-3.5 = strong, and >3.5 = severe.

within 30cm (Table 2), with examples of the variation in soil strength with depth shown in Figure 1. Nutrients commonly identified as marginal in the top 30cm included N, phosphorus (P), zinc (Zn), copper (Cu) and manganese (Mn).

Monitoring long term amelioration trials

PIRSA long term trials on water repellent sands that have physical and nutritional constraints (Karoonda, Brimpton Lake) or acidity and nutritional constraints (Cadgee) have been monitored for five years. Cumulative yield gains across three cereal years (Table 3) demonstrate that yield gains at Karoonda and Brimpton Lake have been responsive to spading (approx. +2t/ha at both sites). Incorporation of N-rich crop biomass (10t/ha lucerne) has resulted in 1.3-1.6t/ha, and largely accounted for in the first two years. Yield gains from clay incorporation were only evident at Cadgee (+1.8t/ha), which had little response to spading, but a positive and continuing response to N-rich biomass (+1.6t/ha). The lack of strong physical constraint and the presence of acidity at Cadgee are likely drivers of the different responses.

Table 3. Cumulative cereal yields (2014, 2015, 2017) across PIRSA long term amelioration trial.

	Cumulative Yields (3 years, t/ha)		
	Karoonda	Brimpton Lake	Cadgee
Unmodified	2.17	4.36	3.21
Spading	4.13	6.58	2.82
Spading +lucerne	5.39	8.15	4.83
Spaded clay	4.14	7.49	4.62

Lucerne =10t/ha

These long-term experiments have demonstrated lasting responses to spading across three sites, broadly similar gains to the incorporation of lucerne, and site/seasonal responses to clay. A new experiment at Murlong builds on these results to evaluate the potential of topsoil slotting compared to spading, as a lower risk approach to address repellence (severe), compaction and nutritional constraints. The new experiment is co-located with a mitigation experiment evaluating wetter chemistry and placement. Comparing annual lower cost strategies against higher cost amelioration will be important in developing a framework to support grower decisions for cost effective outcomes on repellent sandy soils.

Yield responses to physical disruption and increasing profile fertility

A wide range of experiments have demonstrated that physical interventions (ripping, spading, deep cultivation) can improve crop productivity in compacted sandy soils (for example, Trengove et al. 2018; Moodie and Macdonald, 2018). The extent of the opportunity to further increase yield gains for effective cost benefits through incorporating amendments (fertilisers, manure, crop biomass) is less well understood. Depth of placement and type of amendment influence the rooting depth, the timing of nutrient supply, and access to profile moisture. These factors influence the balance of crop growth, development, and grain filling. A series of experiments across the southern rainfall range have been established to address these questions in deep compacted sands with nutritional limitations (Waikerie, Carwarp, Bute, Ouyen).

Targeting the depth of amelioration to compaction thresholds (with/without deep placement of amendments), three new trials (2018) demonstrate a range of site-specific responses (Figure 2). The potential for yield gains at Waikerie was limited by available water (95mm GS rainfall), with small yield gains under 60cm ripping treatments (+0.26t/ha) and no significant response to deep placed nutrition.

At Carwarp (approximately 70mm GS rainfall), the yield responses to a range of amelioration approaches (ripping, spading) were relatively consistent (+0.5t/ha) and unaffected by depth, despite evidence of deeper crop water use. Increasing profile nutrition through incorporation of N-rich biomass had either no benefit (deep placed) or a negative yield effect (spading) associated with high early biomass production.

In contrast to the dominance of physical effects at Waikerie and Carwarp, crop yields at Bute were more responsive to improved nutrition (7.5t/ha surface chicken litter), demonstrating yield gains of approx. 0.9t/ha compared to an average gain of 0.29t/ha from physical interventions alone. The Bute site had the lowest severity and depth of physical constraint across project sites (Figure 1). All trials will continue for a further two years to evaluate the longevity of physical and nutrient carry-over effects.

Established in 2017, a trial at Ouyen is evaluating the incorporation (spading) of farm grown biomasses (vetch hay, oaten hay). It includes other amendments to allow regional comparisons (chicken litter) and assess longevity compared to complex/stable carbon inputs (compost). In the first-year spading suffered an establishment penalty (110 vs. 60 plants/m^2), resulting from sub-optimal seeding depth control, with spaded yields tending to only have a small benefit (+0.4t/ha) compared to the control (1.3t/ha). The two-year cumulative gain from spading alone was 0.58t/ha. Incorporation of

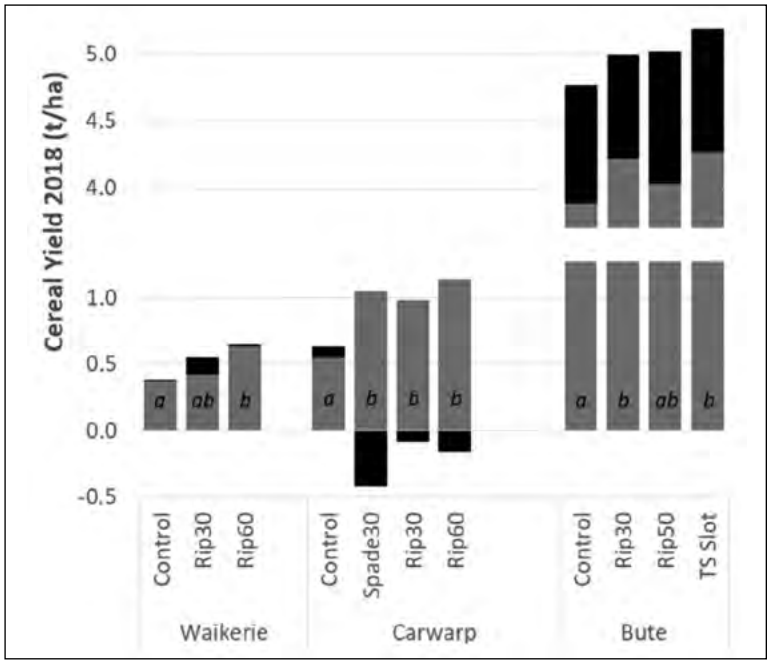

Figure 2. Cereal yields across three amelioration trial sites including non-ameliorated control, ripped (Rip30, Rip50, Rip60), spaded (Spade30), or topsoil slotted (TSSlot30) treatments, and where numbers indicate depth (cm) of intervention. Grey bars represent yields under control fertiliser inputs, while black bars indicate gains/losses under nutrient enriched treatments. Letters indicate significant amelioration impacts within sites (n=4), noting broken y-axis to account for higher yields.

N-rich amendments (vetch, chicken litter, compost) supported higher yields over both years (2.9-3.5t/ha cumulative totals), representing gains of 0.85-1.73t/ha over and above the spaded control. Where high fertiliser additions (156kg N/ha, matching vetch N input) were incorporated through spading, yields were comparable but far more variable between replicates. Measurement of the rates of microbial decomposition and changes in soil N pools (mineral N, microbial biomass N and dissolved organic N) indicate differences in nutrient cycling between treatments that will be monitored over time.

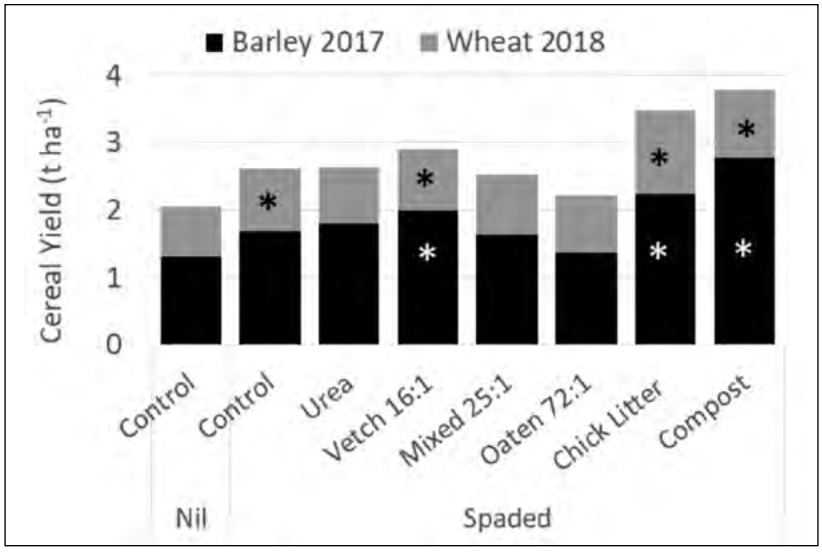

Figure 3. Cereal yields in response to spading and amendment incorporation at Ouyen, Victoria. Yields include two consecutive years following establishment in 2017; significant within year differences from the unspaded (Nil) control are indicated (*). Treatments include an undisturbed (Nil) control, and spaded treatments with no additional inputs (control), urea, three hays including vetch, oaten hay and a mixture of the two (C:N ratio indicated), chicken litter, and compost.

Conclusions

There are substantial opportunities to increase yield on underperforming sandy soil in the Southern Region. However, it is important to consider the current yield gap, the expected yield gains, and the seasonal risks within the low to medium rainfall environment. Identifying the key soil constraints limiting crop root growth and water extraction is central to developing a targeted and cost-effective amelioration plan.

Across the Southern Region, compaction and yield responses to physical disruption are common but not guaranteed. Considering the depth and severity of compaction and the co-occurring soil constraints is important. Opportunities to optimise physical amelioration include understanding machinery specific impacts on soil strength and mixing ability and improving seeding depth control for even crop establishment. Experiments aiming to increase yields through incorporating or deep placing fertilisers or organic amendments demonstrate high seasonal variability, with risks of neutral or negative yield responses in dry years. Understanding the impact of placement depth and amendment form on the timing of nutrient supply and water use is required to harness any additional potential above physical intervention alone. Interactions with site, season and/or crop sequence have been demonstrated and highlight the need to better understand post-amelioration agronomy.

Useful resources and references

PIRSA GRDC Sandy soils (CSP00203) site results summary. (http://www.pir.sa.gov.au/__data/assets/pdf_file/0008/297719/PIRSA_New_Horizons_Trial_Sites_Summary_2017.pdf)

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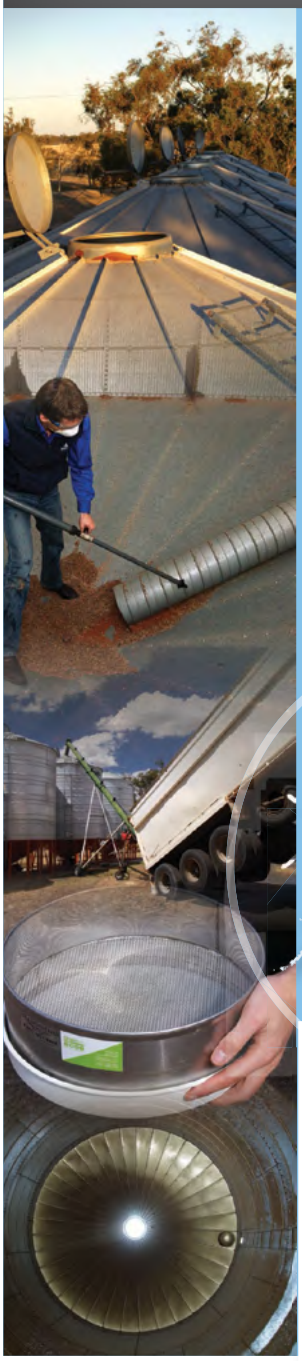

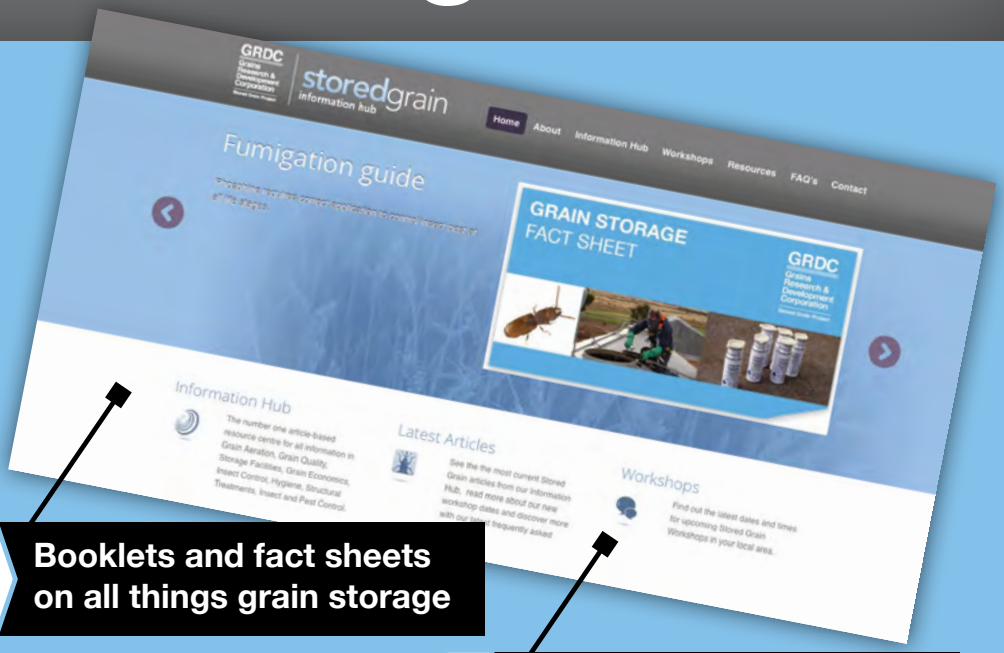

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Cereal foliar and root disease update 2019

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GRDC project codes: DAV00129, DAV00128, DAN00175, DAS00137, DAW00245, DAV00144, DAV00136

Keywords

- yellow leaf spot, rust, septoria, stubble borne disease, root lesion nematodes, crown rot, cereal cyst nematode, net blotch.

Take home messages

- Proactive disease management can minimise losses associated with root and foliar diseases.
- Avoiding highly susceptible varieties where possible provides effective disease control.
- Identifying paddocks at risk of root disease prior to sowing using PREDICTA® B testing enables strategies to minimise yield loss to be implemented.

Background

Dry conditions during 2018 meant cereal diseases were generally of limited concern. However, Agriculture Victoria (AgVic) field trials still measured yield losses of 12% due to foliar diseases and more than 50% due to crown rot, highlighting the importance of effective disease management strategies.

Cereal disease management in 2019

Cereal diseases will require proactive management prior to and during the 2019 season. Often, following dry seasons where diseases had limited impact, there is a temptation to be complacent about preventative disease management strategies, especially when cash flows are constrained. However, 2016 should serve as a reminder of how challenging disease management can be in a wet season following the dry season of 2015.

The widespread early summer rain across Victoria (December 2018) will likely support a green bridge (volunteer cereals growing over summer/autumn) that will carry over rust and viral diseases to provide early infection of crops in 2019. Likewise, dry conditions during 2018 will have limited the breakdown of stubble. This is likely to increase the carryover of stubble borne pathogens (e.g. crown rot, yellow leaf spot (YLS) and net blotch fungi) into 2019, even from cereal crops grown in 2017.

For 2019, a disease management plan that considers variety rating (consult a current disease guide) and inoculum loads within a paddock (consider stubble and soilborne diseases and cropping history) and the district (consider the green bridge) should be adopted. A fungicide strategy should then be developed for each crop based on the identified risks. Diseases can be cost effectively controlled when a proactive management approach is used.

Wheat foliar diseases

In general, wheat foliar diseases had minimal impact on wheat production during 2018. Septoria tritici blotch (STB) required management in the Western District, but did not progress under drier conditions in the Wimmera. Stripe rust and leaf rust appeared late in the 2018 season, but did not affect crop yield. There were no reports of stem rust in Victoria during 2018.

Rust in wheat

Widespread rain across Victoria in the early summer (December 2018) will support the growth of volunteer cereals that will act as a green bridge to carry rust inoculum over into the 2019 season. Rust is most severe in seasons following wet summers where there are large areas of uncontrolled cereal volunteers (green bridge).

Rust carryover can be reduced by removing volunteer cereals in paddocks by the end of February, thus providing a break in the life cycle of rusts from one season to the next. Removing volunteers also provides benefits for water storage, general management of weeds and other pests and diseases such as aphids and viruses.

Following a wet summer, it is important that increased attention is given to the management of cereal rusts. Where possible, avoid susceptible varieties to the three rusts (consult a current Cereal Disease Guide) and develop plans for rust management during 2019. At sowing, use of the fungicide flutriafol on fertiliser or fluquinconazole on seed has proven successful in delaying the onset of stripe rust epidemics in seasons where a significant green bridge risk existed.

Septoria tritici blotch

Septoria tritici blotch (STB) is currently the most important foliar disease of Victorian wheat crops. It is most severe in the high rainfall zone and widespread in the Wimmera, but did not develop to damaging levels in 2018 due to the dry spring. AgVic, with support from GRDC, assesses National Variety Trial (NVT) lines for their reaction to STB in the field at Hamilton to ensure new varieties have current Victorian relevant ratings.

An integrated approach that incorporates crop rotation (avoiding paddocks with infected wheat stubble), variety selection (avoid susceptible varieties) and in-crop fungicide application can provide effective suppression of STB. Identification of pathogen strains with partial resistance to common fungicides highlights the need to adopt an integrated control approach that is not solely reliant on fungicides.

Yellow leaf spot

Yellow leaf spot (YLS) is a common stubble borne foliar disease of wheat that is favoured by growing susceptible varieties and stubble retention practices. Previous studies by AgVic have demonstrated yield losses of up to 23%. Partial disease control which significantly reduces the level of yield loss in susceptible varieties is achieved with the application of a foliar fungicide (i.e. Prosaro®, (prothioconazole/tebuconazole)) at both stem elongation (Z31) and flag leaf emergence (Z39).

During 2017 and 2018, AgVic conducted field experiments near Horsham to compare fungicides and fungicide combinations for their ability to control YLS in comparison to a disease-free and an unsprayed control (Table 1). YLS infection was established by applying 1kg of infected wheat stubble to each plot. Disease severity, measured as percentage leaf area affected (%LAA), was assessed multiple times between mid-tillering (Z25) and mid anthesis (Z65). In 2018, no assessments were done post mid ear emergence (Z55) due to dry conditions. Grain yield and quality were also measured from harvest samples.

The effect of fungicide treatments on YLS severity during an average rainfall season in 2017 (393mm total) and a below average season in 2018 (204mm total) are shown in Table 2. Overall, no fungicide provided suppression comparable to the low disease treatment in either season, demonstrating that fungicides should not be

Table 1. Fungicide products applied at Z31 + Z39 (except Uniform® applied to fertiliser), active ingredients, rate and application method, and controls tested for suppression of YLS at Horsham during 2017 and 2018.

Treatment	Application	Rate of application (g ai/ha)	Example trade names
No Fungicide	-	-	Nil
Disease free	Multiple foliar fungicide	63/63	Low disease
Azoxystrobin/metalaxyl-M	Fertiliser	129/50	Uniform®
Azoxystrobin/cyproconazole	Foliar	160/64	Amistar® Xtra, Titan Azoxystrobin Extra®
Propiconazole	Foliar	125	Tilt®, Bumper®
Tebuconazole	Foliar	125	Orius®
Prothioconazole/tebuconazole	Foliar	63/63	Prosaro®
Azoxystrobin/epoxiconazole	Foliar	63/63	Radial®
Tebuconazole/azoxystrobin	Foliar	126/76	Veritas®

relied on for complete suppression of YLS. Of the fungicide products, propiconazole (e.g. Bumper®) and the prothioconazole/tebuconazole combination (Prosaro®) provided the greatest disease suppression in 2017. During 2018, propiconazole (e.g. Bumper®), and combinations of azoxystrobin/epoxiconazole (Radial®) and tebuconazole/azoxystrobin (Veritas®) provided significant suppression of YLS, comparable to the prothioconazole/tebuconazole combination (Prosaro®).

There were significant improvements to grain yield and quality following fungicide application during 2017 (Table 3), but not 2018 (data not shown). During 2017, propiconazole (e.g. Bumper®) and the prothioconazole/tebuconazole combination (Prosaro®) provided significant grain yield improvements over the nil control and the greatest grain quality improvements, comparable to the low disease control. This demonstrated that there were benefits to timely fungicide application with some products during a favourable season. Other

Table 2. Percentage leaf area affected by YLS in wheat variety Phantom$^{\phi}$ on two occasions and AUDPC following different fungicide treatments at Horsham during 2017 and 2018.

	2017			2018		
	Disease severity (%)		AUDPC [A]	Disease severity (%)		AUDPC
Treatments	Z32	Z65		Z34	Z39	
Disease free	1.2 [a]	27.5 [a]	803 [a]	5.8 [a]	14.7 [a]	537 [a]
Propiconazole	13.0 [b]	29.3 [ab]	1594 [b]	15.3 [bc]	24.5 [cd]	989 [bc]
Prothioconazole/tebuconazole	16.7 [bc]	27.8 [a]	1742 [bc]	13.0 [b]	17.8 [ab]	833 [b]
Tebucoanzole/azoxystrobin	21.0 [cde]	32.7 [abc]	2035 [cd]	17.7 [bcde]	22.0 [bc]	1024 [bcd]
Azoxystrobin/cyproconazole	21.2 [cde]	34.2 [bcd]	2108 [cde]	21.2 [def]	26.2 [cde]	1234 [de]
Azoxystrobin/epoxiconazole	20.2 [bcd]	36.2 [cde]	2161 [cdef]	16.3 [bcd]	20.3 [abc]	954 [bc]
Azoxystrobin/metalaxyl-M	31.0 [f]	34.2 [bcd]	2491 [ef]	22.7 [efg]	25.3 [cde]	1228 [de]
Tebuconazole	24.5 [def]	38.5 [de]	2314 [def]	20.0 [cdef]	23.0 [bc]	1103 [cd]
No Fungicide	28.2 [ef]	40.3 [e]	2556 [f]	27.7 [g]	29.7 [de]	1458 [f]
P value	<.001	<.001	<.001	<0.001	<0.001	<0.001
LSD	7.82	5.53	439.7	5.22	6.44	224.2

Values that do not share the same letter in lowercase superscript are significantly different from each other and can be compared within columns only.

[A] AUDPC = Area under disease progress curve, denoting the cumulative disease severity over the growing season.

Table 3. Grain yield and loss plus grain quality of wheat variety Phantom$^{\phi}$ in response to fungicide treatments to control YLS at Horsham during 2017.

	Grain yield		Grain quality	
Treatments	(t/ha)	Loss (%)	Screenings (%) [A]	Retention (%) [B]
Disease free	6.0 [a]	-	9 [a]	73 [a]
Propiconazole	5.8 [abc]	5 [n.s]	10 [ab]	71 [abc]
Prothioconazole/tebuconazole	5.7 [abcd]	5 [n.s]	9 [a]	73 [a]
Tebucoanzole/azoxystrobin	5.6 [bcde]	7	10 [bc]	70 [abcd]
Azoxystrobin/cyproconazole	5.5 [cde]	8	10 [bc]	70 [bcd]
Azoxystrobin/epoxiconazole	5.5 [cdef]	9	11 [bc]	68 [cd]
Azoxystrobin/metalaxyl-M	5.3 [def]	12	11 [c]	69 [bcd]
Tebuconazole	5.2 [ef]	14	11 [c]	67 [de]
Nil	5.2 [ef]	13	13 [d]	64 [ef]
P value	<.001		<.001	<.001
LSD	0.40		1.39	3.13

General analysis of variance with Fishers protected LSD used for analysis.

Letters in lowercase superscript can be compared within columns only.

n.s = non-significant differences from low disease control.

[A] Screenings = % of grain less than 2.2 mm wide. [B] Retention = % of grain greater than 2.5mm wide.

fungicides products did not provide significant yield improvements, but did provide improvements to grain quality, compared to the nil treatment.

The findings from this study were comparable to previous studies that showed that foliar fungicide application at Z31 and Z39 can provide significant improvements to grain yield and quality during seasons favourable to the development of YLS, where yields are average or greater. However, fungicides did not provide economic benefit during dry seasons. Where possible, use variety and paddock selection to minimise risk from YLS as this will be more effective.

Barley foliar disease management

Foliar diseases had little impact on barley crops in Victoria during 2018 due to the dry conditions. Spot form (SFNB) and net form of net blotch (NFNB) and scald were at low levels while leaf rust and powdery mildew were generally absent.

Net form of net blotch

Net form of net blotch (NFNB) is becoming an important foliar disease of barley due to the cultivation of susceptible varieties such as RGT Planet$^{\Phi}$ and in some regions, Fairview$^{\Phi}$ and Oxford$^{\Phi}$. Field experiments at Horsham during 2017 showed grain yield losses of up to 22% (2t/ha), as well as grain quality losses in a high yielding season (approx. 8 t/ha) with good spring rainfall.

Field experiments conducted near Horsham (Wimmera) and Birchip (Mallee) during 2018 determined grain yield and quality loss in three barley varieties with different levels of resistance to NFNB and one very susceptible old breeding line, VB9613. Two treatments were applied: 1) No disease - fungicide treatment which had Systiva® applied to seed and foliar applied Prosaro® at stem elongation (Z31) and flag emergence (Z39) to determine grain yield and quality potential, and 2) Disease treatment, which had no fungicide application and 1kg of NFNB infected barley stubble added, to determine loss.

The Horsham trial was in a paddock with good sub-soil moisture, supporting grain yields of approximately 4.5t/ha, despite growing season rainfall being well below average. Scald infection was present in Fathom$^{\Phi}$, Commander$^{\Phi}$ and RGT Planet$^{\Phi}$, which may have affected grain yield slightly. Up to 24% of leaf area was affected by NFNB in the very susceptible line VB9613. This resulted in a 12% reduction in grain yield (Table 4) and losses in grain plumpness and weight, demonstrating the importance of not growing very susceptible varieties as they can have losses during any season with good yield potential. NFNB developed late in the season in the susceptible to very susceptible (SVS) rated RGT Planet$^{\Phi}$, but did not cause grain yield loss and only caused minor grain quality loss. This contrasted with the Horsham site during 2017, where RGT Planet$^{\Phi}$ had 22% grain yield loss and significant grain quality losses. This highlights that seasonal conditions are important to disease development and that NFNB is unlikely to be an issue during dry seasons except if a very susceptible variety (VS) is grown.

Fathom$^{\Phi}$ (moderately resistant to moderately susceptible (MRMS)) and Commander$^{\Phi}$ (moderately susceptible (MS)) had little or no NFNB infection and no losses to grain yield or quality, showing that MS or better rated varieties can be sufficient to avoid loss due to NFNB in low disease pressure seasons.

The Birchip site had less than 5% of leaf area affected by NFNB (data not shown) and grain yield was less than 0.7t/ha in all varieties and treatments (data not shown), indicating that water was the main limiting factor to yield. This demonstrated the importance of reviewing disease management plans during the season and not unnecessarily applying fungicides in such a dry season.

Red leather leaf of oats

Red leather leaf is a common stubble and seed-borne foliar disease of oats caused by the fungus *Spermospora avanae*. To date, there has been little

Table 4. NFNB severity, grain yield and quality loss of three barley varieties and one VS rated breeding line at Horsham during 2018.

	NFNB Severity (%) 18/10 (Z85)	Grain yield loss (t/ha)[A]	Grain quality loss (%)[A]		
			Retention (>2.2 mm)	Screenings (<2.2 mm)	Weight (g)
Fathom$^{\Phi}$ (MRMS)	0.2	0.3 (7%)^{ns}	0	0	0
Commander$^{\Phi}$ (MS)	0.8	0.2 (4%)^{ns}	1ns	0	0
RGT Planet$^{\Phi}$ (SVS)	5.0	0.1 (2%)^{ns}	1*	0	2^{ns}
VB9613 (VS)	23.8	0.5 (12%)*	7*	1*	5*

**=Significant difference between the fungicide and disease treatments at 0.05. ns = Not significant.*

research to determine its impact on oat production or identify effective control strategies. AgVic conducted separate variety yield loss and fungicide experiments near Horsham during 2018 to help develop management strategies.

The yield loss experiment consisted of four milling grade varieties (Table 5) with different resistance ratings to red leather leaf, with six replicates each of two treatments: 1) Disease free - three fungicide applications to minimise disease, and 2) Disease - no fungicide and 1kg of red leather leaf infected oat stubble applied to determine loss.

Despite the low rainfall during 2018, the oats yielded 3-4t/ha with up to 18% red leather leaf infection by season's end. Kowari(ф) and Bannister(ф) both had significant grain yield loss in infected plots (Table 5). Kowari(ф) also lost grain quality, which is a potential concern for milling oat growers. No grain yield or quality loss was measured for Williams(ф) or Mitika(ф), most likely due to crop maturity in relation to disease development.

These findings demonstrate that red leather leaf caused grain yield and quality loss in milling oats, even during a dry season. Losses were variable between varieties and are likely to be greater during wetter seasons that favour disease development later in the season.

Fungicides

To evaluate fungicide strategies for the management of red leather leaf in oats, three fungicide applications timings (Z25, Z31 and Z39) were compared with an untreated control in the susceptible oat variety Mitika(ф). Disease severity was assessed six times (27 July, 6 and 23 August, 5 and 11 September and 2 October) during the growing season and grain yield and quality measured. There was no significant effect of fungicide on grain yield or quality, so this data has not been presented.

Red leather leaf symptoms were first observed during mid-July which developed rapidly during late August and early September (Figure 1) in response to wet weather. There was little disease development during the spring months due to dry conditions. Red leather leaf suppression varied between foliar fungicide timings with application at tillering (Z25) providing the best suppression (Figure 1) and application at stem elongation (Z31) was the next most effective. This was due to fungicide application coinciding with the onset of early disease development in 2018. Foliar fungicide at flag leaf emergence (Z39) was less effective, due to the application being after the majority of disease had already developed.

Red leather leaf develops rapidly, given the right conditions. As a result, multiple fungicide applications may be required. Further studies are required to provide more robust management recommendations to oat growers.

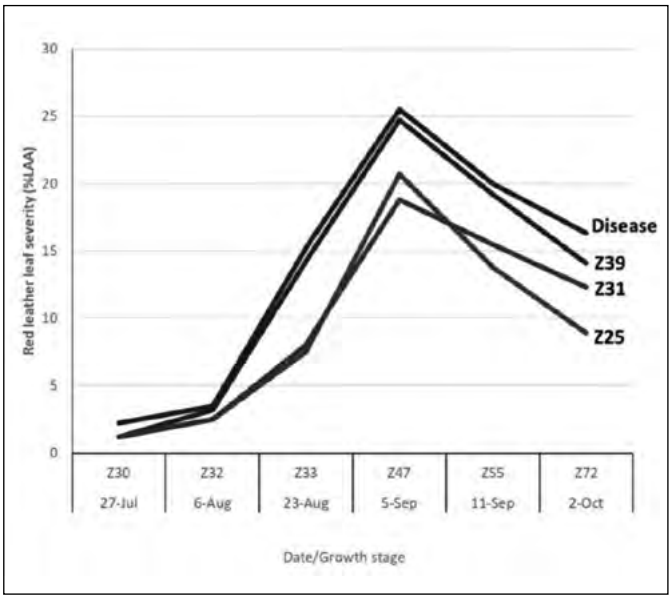

Figure 1. Red leather leaf development in susceptible oat variety Mitika(ф) in response to application of foliar fungicide, propiconazole (125 g ai/ha) at different growth stages in comparison to a no fungicide, disease treatment.

Table 5. Red leather leaf severity, grain yield and quality loss of four milling oat varieties at Horsham during 2018.

	Red leather leaf severity (%LAA)[A] 2 Oct (Z72)		Grain yield		Grain quality loss (%)[B]		
Variety	Dis.	Fung.	t/ha	Loss	Retention (>2.5mm)	Screenings (<2.2mm)	Grain weight
Kowari(ф) (MRMS)	17.8	12.7	3.0	0.3 (10%)* [B]	9*	4*	2*
Bannister(ф) (MS)	13.3	6.9	4.0	0.5 (12%)*	1^{ns}	2^{ns}	1^{ns}
Williams(ф) (MS)	9.4	11.5	3.5	0	0	0^{ns}	0
Mitika(ф) (S)	16.1	12.6	3.0	0	1^{ns}	0^{ns}	2^{ns}

[A] *%LAA = percentage of leaf area affected.*

[B] **=Significant difference between the fungicide and disease treatments at 0.05. ns = Not significant.*

Soilborne diseases

Yield losses caused by root diseases often go unrecognised as symptoms are below ground and even if their effects become apparent, there are no in-crop management solutions available. A PREDICTA® B test taken before planting provides an effective way to detect paddocks at risk of root diseases and enables management strategies to be implemented.

Recent economic studies demonstrated annual average yield losses of 7% and 1% due to crown rot and root lesion nematodes, respectively, across Victoria and South Australia (SA). Within individual situations, however, field trials during 2018 in Victoria demonstrated yield losses from crown rot of 42% and 65% in bread and durum wheat crops, respectively (Table 6), demonstrating how damaging this disease can be.

Crown rot

Crown rot is now possibly the most important disease affecting wheat crops in Victoria and nationally. A recent study of 1502 PREDICTA® test results from across Victoria and SA (2015-2017) found that 36% of paddocks tested had a medium or high level of crown rot inoculum prior to sowing. Annual average yield losses across all wheat crops in Victoria and SA were estimated to be 6.6% with losses up to 10% in seasons conducive to crown rot. Field trials conducted by AgVic have demonstrated that in paddocks where crown rot is present, yield losses greater than 30% can occur.

The extent of yield loss caused by crown rot is related to the level of inoculum present in the paddock at planting, the seasonal conditions and variety susceptibility (Table 6). Hence, growers can use a PREDICTA® B test to establish the level of risk present in a paddock prior to sowing and implement appropriate management strategies if necessary.

Seasonal conditions have a large influence on the yield loss caused by a given level of crown rot infection (Table 6). For example, during the wet season of 2016, the medium crown rot inoculum levels caused no yield loss, but during the driest season (2018) the same level of inoculum caused a 35% reduction in grain yield in the susceptible variety Cobra$^{\Phi}$.

Cereals vary in their extent of yield loss in the presence of crown rot. As shown in Table 6, during 2015 at the high inoculum level, yield loss in the bread wheat Emu Rock$^{\Phi}$ (MS) was 12%, while in the bread wheat Cobra$^{\Phi}$ (S) was 35% and the durum wheat WID802 (VS) was 63%. This clearly shows the benefit of avoiding highly susceptible varieties in paddocks with medium to high levels of crown rot inoculum.

In paddocks with high levels of crown rot, it is best to avoid growing cereals. Previous work has shown that cereals increased inoculum levels, while

Table 6. Effect of seasonal conditions, increasing crown rot inoculum levels at planting and varietal susceptibility on yield loss with yield potential and growing season (April to October) rainfall at Horsham during the years 2015 to 2018.

Year	Yield Loss (%)			Yield Potential (t/ha)	GSR (mm) Apr-Oct
	Crown Rot Level (g/m row)				
	Low (0.25)	Medium (1.0)	High (2.0)		
Bread Wheat, cv. Emu Rock$^{\Phi}$ (MS to crown rot)					
2015	0	15	12	3.15	142
2016	0	0	0	6.55	374
2017	0	0	0	4.44	303
2018	0	0	0	2.53	187
Bread Wheat, cv. Cobra$^{\Phi}$ (S to crown rot)					
2015	18	29	35	3.14	142
2016	0	0	0	7.24	374
2017	0	9	17	4.12	303
2018	0	35	42	2.36	187
Durum Wheat, cv. WID802 (VS to crown rot)					
2015	19	50	63	3.10	142
2016	0	0	0	7.69	374
2017	0	12	25	4.32	303
2018	0	22	65	2.52	187

broadleaf break crops (e.g. canola and pulses) and fallow decreased inoculum levels of crown rot. In general, a two-year break from cereals is required to reduce medium to high inoculum levels to a low level. A three-year break may be required following the dry season of 2018 due to the decreased decomposition of cereal stubble.

Rhizoctonia root rot

The dry 2018 season will have favoured the build-up of *Rhizoctonia solani* AG8 levels within paddocks. Significant summer rainfall will decrease inoculum levels if volunteer cereals and summer weeds (green bridge) are effectively controlled. The impact of rhizoctonia root rot on crops sown in 2019 will be reduced if the season breaks early and crops establish in warmer soil. Rhizoctonia is most damaging when root growth is restricted either by cold soils, compaction layers or lack of moisture. Crops that establish well can still be affected in mid-winter when soil temperatures drop below 10°C at which point Rhizoctonia can attack the crown roots causing uneven growth and reduced tiller number, rather than classic bare patch symptoms.

If growing cereals in 2019, a PREDICTA® B test can be used to identify paddocks at risk. If Rhizoctonia is present at high levels, control summer weeds and autumn green bridge and consider rotating to a non-cereal crop. If a cereal is to be grown, wheat is more tolerant than barley and early sowing in the seeding window with banding of nitrogen (N) below the seed to facilitate rapid root growth can also limit early impacts. Ensure good crop nutrition, with particular attention to trace elements, and increase seeding rates to reduce impact of lost tillers from Rhizoctonia damage to crown roots.

Consider fungicide seed treatments to protect the roots. Rainfall is needed to move fungicides into the root zone as roots outside the fungicide zone are not protected. Seed treatments tend to protect the seminal roots, whereas liquid streaming Uniform® above and below the seed can protect crown and seminal roots and tends to produce larger yield responses in above average rainfall seasons.

Root lesion nematodes

The root lesion nematodes (RLN), *Pratylenchus neglectus* and *P. thornei* are widespread in Victorian cropping paddocks. A recent study of 1,965 PREDICTA® B test results from across Victoria and SA (2013-2017) found that RLNs were present in 92% of paddocks with approx. 10% of paddocks having a medium or high test result. This report estimated the annual average yield loss across all wheat crops in Victoria and SA to be 1% with losses up to 2% in seasons conducive to losses from RLNs. Field trials conducted by AgVic and SARDI have demonstrated that in paddocks where RLNs are present, yield losses greater than 10% can occur.

Using data collected from many field trials conducted in Victoria and SA, the PREDICTA® B risk categories were updated for RLNs (Table 7). These revised risk categories reflect that yield losses due to RLNs do not occur in all seasons and our improved understanding of the extent of yield losses that they cause.

Table 7. Revised *P. thornei* and *P. neglectus* PREDICTA® B risk categories for Victoria and SA for seasons that range in their conduciveness for yield loss in intolerant varieties.

Risk Category	RLN /g soil	Seasonal Conditions and Frequency[A]		
		Conducive 40%	Intermediate 30%	Non-conducive 30%
		Yield Loss %		
Pratylenchus thornei				
BDL[B]	<0.1	0	0	0
Low	0.1-14	0-5	0-2	0
Medium	15-60	5-20	2-10	0
High	>60	20-40	10-20	0
Pratylenchus neglectus				
BDL	<0.1	0	0	0
Low	0.1-24	0-5	0-2	0
Medium	25-100	5-20	2-10	0
High	>100	20-40	10-20	0

[A] *Conducive and non-conducive season are those where yield loss does and does not occur, respectively, due to the nematodes. The historical frequency of these occurrences is provided as percentages. The conditions that favour yield loss are not understood.*

[B] *BDL, below detection level.*

To keep nematode densities below yield limiting thresholds, it is important to grow varieties with a MR/MS or better resistance rating. If susceptible varieties are grown, it is important they are rotated with resistant crops or varieties and nematode densities monitored using a pre-sowing PREDICTA® B test. If medium to high nematode densities are present, consider growing resistant crops or varieties. Consult current Cereal and Pulse Disease Guides for the latest RLN resistance ratings as it is important to check the resistance rating of varieties due to varietal variation within crops for resistance/susceptibility to RLN species.

Bunts and smuts

Seed treatments provide cheap and effective control of bunt and smut diseases. Seed should be treated every year as bunt and smut can increase rapidly, resulting in unsaleable grain. Good coverage of seed is essential and clean seed should be sourced if a seed lot is infected. Fertiliser treatments do not control bunt and smuts, so seed treatments are still required.

Conclusion

In the absence of proactive disease control, yield losses due to diseases can be greater than 20%. It is, therefore, important that plans are developed to effectively manage wheat diseases this season.

Useful resources

Current Victorian Cereal Disease Guide: http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/cereal-disease-guide

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Putting it all together for the 2019 cropping season

Simon Craig.

Farm360 Pty Ltd.

Keywords

- farm planning, inputs, management, dry seasons, risk, fertilisers, fungicides, seed, varieties.

Take home messages

- Knowing your yield potential at the start of the season allows growers and advisers to make decisions on which inputs are required. If there is good soil moisture, inadequate crop inputs for the 2019 crop, may result in lost opportunities to get your business back on track following the dry 2018.
- Reducing expenditure on variable costs such as crop inputs, repairs and labour without justification can be counterintuitive to getting the business out of trouble. Summer weed control and rotation management are fundamental to growing a crop (especially a cheaper one) and should not be jeopardised by budgets.
- Savings this year can certainly be made regarding reduced use of up-front fungicides and fertilisers. However, it's important to validate and assess the risks before making the decision.

Background

For many growers in the Mallee and northern Wimmera, 2018 was one to forget – except for Collingwood losing the Grand Final! With most grain growing areas receiving less than 30% of their average growing season rainfall and a high number of frosts it was expected that many crops would yield well below average. However, there were pockets where growers and advisers were surprised with yields still achieved. With the grain prices that were experienced at harvest, those small yield gains were the difference between making a significant loss and covering costs or dare we say it 'making a profit'! Many have attributed the profit despite a difficult season to the changes in farming systems, soil type, time of sowing, varieties, summer weed control and rotations and they would not be wrong. It is for this reason that we cannot fall into the mistake of blanket cutting all costs to recoup losses from the previous season, as certain inputs are vital to achieving relative yield potential.

Crop nutrition

This paper will focus on the most obvious of the input savings – the reduction of up-front fertiliser, mainly phosphorus (P). Phosphorus is essential for root development and is required at the very early stages of the crop's development. It can help to counteract root diseases and in some cases herbicide residues. It also assists with tiller production, which couples with the decision on seeding rates – for example, if you reduce your seeding rates, you will require more tillers, and therefore, more fertiliser to promote tillers. Inversely, if you reduce your fertiliser rates, then you will have less tillers, and therefore, a greater need for higher seeding rates.

However, often only 30% of paddocks are responsive to applied P. To determine a paddock's responsiveness to applied P, a soil test is recommended. This will cost approximately $30-$35/paddock or zone. By understanding the level of P in the soil, fertiliser rates can be tailored not reduced, to ensure timely application of fertiliser on a paddock in a location where it is likely to improve yield.

There are two commonly used tests; Colwell P and DGT. Often these tests are accompanied by a measure of the Phosphorus Buffering Index (PBI) which it essential to determine the P holding

capacity of the soil, or in other words; the availability of the P in the soil. In terms of Colwell P, no longer does the 15ppm result act as the threshold, instead, the relationship between Colwell P and PBI is used to determine a Critical Colwell P (CCP). The CCP is determined by the following formula: CCP = 4.6 x ($PBI^{\wedge 0.393}$). If the Colwell P value is **below** the CCP then the paddock is estimated to be **responsive** to P application, if the value is **greater than** the CCP then **responses are unlikely**.

Example 1

Colwell P = 28ppm, PBI 150. CCP = 4.6 x ($150^{\wedge 0.393}$) = 33ppm. The initial Colwell P value is lower than the CCP, thus the paddock is deemed to be **responsive**.

These results suggest that it is possible to save significant amounts of money by tailoring fertiliser rates without compromising yields and subsequent income. Remember, by the time we see P deficiency it's too late and we cannot correct by applying in-crop, so use the results to determine your rates.

Crop rotations

Intended crop rotations can also be ignored following a drought, with most growers reducing the area sown to higher risk crops such as canola and pulses. There is nothing wrong with this strategy, however, the benefit of break crops has been evident in recent years and the definition of a break crop doesn't need to be limited to just canola and pulses. Fallow, pasture and hay can all provide a lower cost alternative to higher risk break crops. If soil moisture at sowing is low, then target those low-cost alternatives to higher risk (lower productive) soil types. This may allow greater investment (e.g. weed management or nutrition) into the more productive paddocks.

Crop protection

In terms of expenditure on up-front fungicides such as Intake®, Systiva® and Uniform®; consider the risks of early disease infection and how you would manage an early outbreak. Aside from favourable seasonal conditions that you cannot control, key drivers that favour early epidemics include a 'green bridge' and use of susceptible varieties. For most areas, there is a relatively low risk of a green bridge, so that leaves it up to varietal choice. If planning to grow a susceptible variety, important to consider whether there is an alternative option of a variety that provides a similar yield potential but with a better disease package? It is one of the easiest changes you can make, but for many there is a tendency to stick to what we know. Consequently, if the green bridge risk is low, consider delaying the up-front cost for fungicides and be prepared to reassess in-crop and spray if disease is being observed in the region.

There are some up-front seed dressings that should continue to be applied irrespective of the poor season in 2018 and these are products that control smuts and bunts in cereals and imidacloprid (Gaucho®) for the control of aphids, most notably Russian Wheat Aphid[1].

Grain marketing

The other important factor for improving financial budgets is grain marketing. It is a very challenging, rewarding but also cruel practice. The greatest lessons I have learnt and seen, is not to be greedy but also avoid receiving the lowest price. At the beginning of the 2018/19 harvest, prices exceeded $400/t for wheat and barley. Despite this good price, some growers currently still have most of their cereal crops unsold and the price has dropped substantially. It is uncertain where this market will go or what will happen as the season progresses however, the lesson from this experience has been that despite the domestic demand being high, the grain prices don't just keep climbing after harvest. Other factors out of our control such as the trade war between China and US and the anti-dumping complaints on barley imports into China were unpredictable and not welcome. If growers are happy with the price and the risk of downside to our budgets is greater than the rewards, then why hold off? Sell.

Conclusion

While this paper has focused on the importance of up-front inputs for your farming system, if a business is in short term trouble then the whole farm business needs to be reviewed and in most cases these issues need to be discussed with your banker and adviser(s). Spending time developing a cash flow budget will help you determine your requirements for the season and enable you to determine whether it's necessary to discuss with your banker/adviser extending financing options.

Following a dry season, your advisers, whether they be a retail or private agronomist, accountant

[1] Current advice from aphid experts at SARDI and CESAR is that: *Insecticide seed treatments, while efficacious, should be used with caution and given priority in areas of high risk of infestation of RWA in 2019.*

and/or grain marketer become of greater value to your business compared with an average or above season. Generally, they are there to improve your business, not drive it into the ground. A good adviser will help you make informed decisions rather than blanket cost savings. Peers or neighbours are also a good resource to bounce ideas off and attending events like this GRDC Grains Research Update will also assist you in getting the latest information on specific issues.

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GRAINS RESEARCH & DEVELOPMENT CORPORATION

CHAIR - JOHN BENNETT

Based at Lawloit, between Nhill and Kaniva in Victoria's West Wimmera, John, his wife Allison and family run a mixed farming operation across diverse soil types. The farming system is 70 to 80 percent cropping, with cereals, oilseeds, legumes and hay grown. John believes in the science-based research, new technologies and opportunities that the GRDC delivers to graingrowers. He wants to see RD&E investments promote resilient and sustainable farming systems that deliver more profit to growers and ultimately make agriculture an exciting career path for young people.

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DEPUTY CHAIR - MIKE MCLAUGHLIN

Mike is a researcher with the University of Adelaide, based at the Waite campus in South Australia. He specialises in soil fertility and crop nutrition, contaminants in fertilisers, wastes, soils and crops. Mike manages the Fertiliser Technology Research Centre at the University of Adelaide and has a wide network of contacts and collaborators nationally and internationally in the fertiliser industry and in soil fertility research.

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PETER KUHLMANN

Peter is a farmer at Mudamuckla near Ceduna on South Australia's Western Eyre Peninsula. He uses liquid fertiliser, no-till and variable rate technology to assist in the challenge of dealing with low rainfall and subsoil constraints. Peter has been a board member of and chaired the Eyre Peninsula Agricultural Research Foundation and the South Australian Grain Industry Trust.

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JON MIDWOOD

Jon has worked in agriculture for the past three decades, both in the UK and in Australia. In 2004 he moved to Geelong, Victoria, and managed Grainsearch, a grower-funded company evaluating European wheat and barley varieties for the high rainfall zone. In 2007, his consultancy managed the commercial contract trials for Southern Farming Systems (SFS). In 2010 he became Chief Executive of SFS, which has five branches covering southern Victoria and Tasmania. In 2012, Jon became a member of the GRDC's HRZ Regional Cropping Solutions Network.

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FIONA MARSHALL

Fiona has been farming with her husband Craig for 21 years at Mulwala in the Southern Riverina. They are broadacre, dryland grain producers and also operate a sheep enterprise. Fiona has a background in applied science and education and is currently serving as a committee member of Riverine Plains Inc, an independent farming systems group. She is passionate about improving the profile and profitability of Australian grain growers.

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ROHAN MOTT

A fourth generation grain grower at Turriff in the Victorian Mallee, Rohan has been farming for more than 25 years and is a director of Mott Ag. With significant on-farm storage investment, Mott Ag produces wheat, barley, lupins, field peas, lentils and vetch, including vetch hay. Rohan continually strives to improve productivity and profitability within Mott Ag through broadening his understanding and knowledge of agriculture. Rohan is passionate about agricultural sustainability, has a keen interest in new technology and is always seeking ways to improve on-farm practice.

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RICHARD MURDOCH

Richard along with wife Lee-Anne, son Will and staff, grow wheat, canola, lentils and faba beans on some challenging soil types at Warooka on South Australia's Yorke Peninsula. They also operate a self-replacing Murray Grey cattle herd and Merino sheep flock. Sharing knowledge and strategies with the next generation is important to Richard whose passion for agriculture has extended beyond the farm to include involvement in the Agricultural Bureau of SA, Advisory Board of Agriculture SA, Agribusiness Council of Australia SA, the YP Alkaline Soils Group and grain marketing groups.

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MICHAEL CHILVERS

Michael runs a collaborative family farming enterprise at Nile in the Northern Midlands of Tasmania (with property also in northern NSW) having transitioned the business from a dryland grazing enterprise to an intensive mixed farming enterprise. He has a broad range of experience from resource management, strategic planning and risk profiling to human resource management and operational logistics, and has served as a member of the the High Rainfall Zone Regional Cropping Solutions Network for the past six years.

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KATE WILSON

Kate is a partner in a large grain producing operation in Victoria's Southern Mallee region. Kate and husband Grant are fourth generation farmers producing wheat, canola, lentils, lupins and field peas. Kate has been an agronomic consultant for more than 20 years, servicing clients throughout the Mallee and northern Wimmera. Having witnessed and implemented much change in farming practices over the past two decades, Kate is passionate about RD&E to bring about positive practice change to growers.

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ANDREW RUSSELL

Andrew is a forth generation grain grower and is currently the Managing Director and Shareholder of Lilliput AG and a Director and Shareholder of the affiliated Baker Seed Co - a family owned farming and seed cleaning business. He manages the family farm in the Rutherglen area, a 2,500 ha mixed cropping enterprise and also runs 2000 cross bred ewes. Lilliput AG consists of wheat, canola, lupin, faba bean, triticale and oats and clover for seed, along with hay cropping operations. Andrew has been a member of GRDC's Medium Rainfall Zone Regional Cropping Solutions Network and has a passion for rural communities, sustainable and profitable agriculture and small business resilience.

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LUCY BROAD

Lucy Broad is the General Manager of the Grains Research and Development Corporation's (GRDC) Grower Communication and Extension business group. Lucy holds a Bachelor of Science in Agriculture, majoring in agronomy, and prior to working at the GRDC spent the last 13 years as Director and then Managing Director of Cox Inall Communications and Cox Inall Change, Australia's largest and leading public relations agency working in the Agribusiness and Natural Resource Management arena. Her entire career has been in communications, first with the Australian Broadcasting Corporation and then overseeing communications and behaviour change strategies for clients across the agriculture, natural resource management, government and not-for-profit sectors.

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2017–2019 SOUTHERN REGIONAL CROPPING SOLUTIONS NETWORK (RCSN)

JANUARY 2019

The RCSN initiative was established to identify priority grains industry issues and desired outcomes and assist the GRDC in the development, delivery and review of targeted RD&E activities, creating enduring profitability for Australian grain growers. The composition and leadership of the RCSNs ensures constraints and opportunities are promptly identified, captured and effectively addressed. The initiative provides a transparent process that will guide the development of targeted investments aimed at delivering the knowledge, tools or technology required by growers now and in the future. Membership of the RCSN network comprises growers, researchers, advisers and agribusiness professionals. The three networks are focused on farming systems within a particular zone – low rainfall, medium rainfall and high rainfall – and comprise 38 RCSN members in total across these zones.

REGIONAL CROPPING SOLUTIONS NETWORK SUPPORT TEAM

SOUTHERN RCSN CO-ORDINATOR: JEN LILLECRAPP

Jen is an experienced extension consultant and partner in a diversified farm business, which includes sheep, cattle, cropping and viticultural enterprises. Based at Struan in South Australia, Jen has a comprehensive knowledge of farming systems and issues affecting the profitability of grains production, especially in the high rainfall zone. In her previous roles as a district agronomist and operations manager, she provided extension services and delivered a range of training programs for local growers. Jen was instrumental in establishing and building the MacKillop Farm Management Group and through validation trials and demonstrations extended the findings to support growers and advisers in adopting best management practices. She has provided facilitation and coordination services for the high and medium rainfall zone RCSNs since the initiative's inception.

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LOW RAINFALL ZONE CO-LEAD: BARRY MUDGE

Barry has been involved in the agricultural sector for more than 30 years. For 12 years he was a rural officer/regional manager in the Commonwealth Development Bank. He then managed a family farming property in the Upper North of SA for 15 years before becoming a consultant with Rural Solutions SA in 2007. He is now a private consultant and continues to run his family property at Port Germein. Barry has expert and applied knowledge and experience in agricultural economics. He believes variability in agriculture provides opportunities as well as challenges and should be harnessed as a driver of profitability within farming systems. Barry was a previous member of the Low Rainfall RCSN and is current chair of the Upper North Farming Systems group.

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LOW RAINFALL ZONE AND MEDIUM RAINFALL ZONE LEAD: JOHN STUCHBERY

John is a highly experienced, business-minded consultant with a track record of converting evidence based research into practical, profitable solutions for grain growers. Based at Donald in Victoria, John is well regarded as an applied researcher, project reviewer, strategic thinker and experienced facilitator. He is the founder and former owner of JSA Independent (formerly John Stuchbery and Associates) and is a member of the SA and Victorian Independent Consultants group, a former FM500 facilitator, a GRDC Weeds Investment Review Committee member, and technical consultant to BCG-GRDC funded 'Flexible Farming Systems and Water Use Efficiency' projects. He is currently a senior consultant with AGRIvision Consultants.

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HIGH RAINFALL ZONE LEAD: CAM NICHOLSON

Cam is an agricultural consultant and livestock producer on Victoria's Bellarine Peninsula. A consultant for more than 30 years, he has managed several research, development and extension programs for organisations including the GRDC (leading the Grain and Graze Programs), Meat and Livestock Australia and Dairy Australia. Cam specialises in whole-farm analysis and risk management. He is passionate about up-skilling growers and advisers to develop strategies and make better-informed decisions to manage risk – critical to the success of a farm business. Cam is the program manager of the Woady Yaloak Catchment Group and was highly commended in the 2015 Bob Hawke Landcare Awards.

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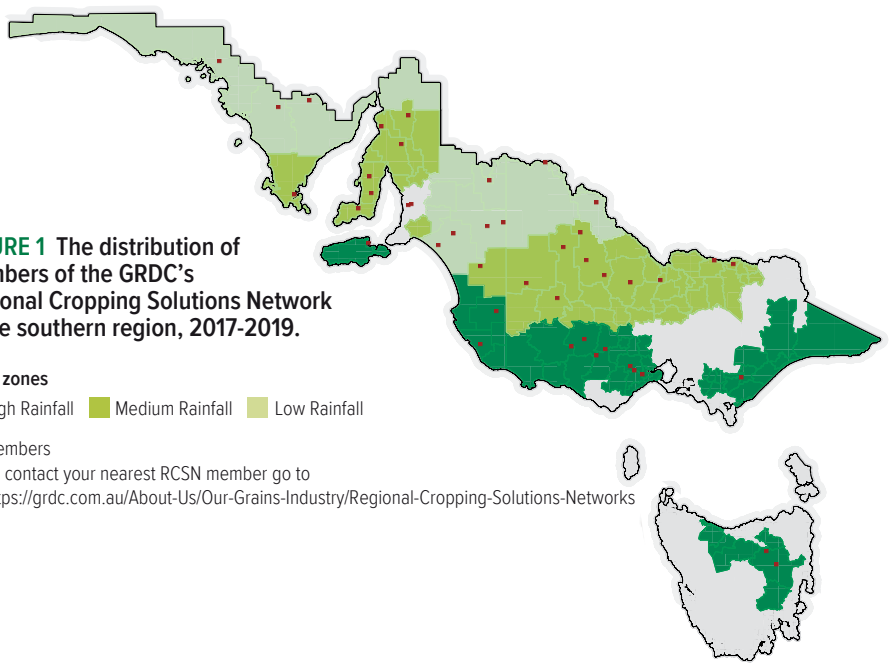

FIGURE 1 The distribution of members of the GRDC's Regional Cropping Solutions Network in the southern region, 2017-2019.

To contact your nearest RCSN member go to https://grdc.com.au/About-Us/Our-Grains-Industry/Regional-Cropping-Solutions-Networks

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- The local GRDC Grains Research Update planning committee that includes both government and private consultants and GRDC representatives.

- Partnering organisation: Mallee Sustainable Farming (MSF).

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Prefer to provide your feedback electronically or 'as you go'? The electronic evaluation form can be accessed by typing the URL address below into your internet browsers:

www.surveymonkey.com/r/Hopetoun-GRU

To make the process as easy as possible, please follow these points:

- Complete the survey on one device
- One person per device
- You can start and stop the survey whenever you choose, **just click 'Next' to save responses before exiting the survey**. For example, after a session you can complete the relevant questions and then re-access the survey following other sessions.

2019 Hopetoun GRDC Grains Research Update Evaluation

1. Name

ORM has permisssion to follow me up in regards to post event outcomes.

2. How would you describe your <u>main</u> role? *(choose one only)*

- ❑ Grower
- ❑ Agronomic adviser
- ❑ Farm business adviser
- ❑ Financial adviser
- ❑ Communications/extension
- ❑ Grain marketing
- ❑ Farm input/service provider
- ❑ Banking
- ❑ Accountant
- ❑ Researcher
- ❑ Student
- ❑ Other* (please specify)

Your feedback on the presentations

For each presentation you attended, please rate the content relevance and presentation quality on a scale of 0 to 10 by placing a number in the box (**10 = totally satisfactory, 0 = totally unsatisfactory**).

3. The war on weeds- latest tips: *Chris Preston*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

4. Hay – how is it 'stacking up'? *Colin Peace*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

5. Cost-effective solutions for ameliorating sandy soils: *Rick Llewellyn*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

6. The crop doctor – 'don't be fooled by the dry conditions': *Grant Hollaway*

Content relevance /10 Presentation quality /10

Have you got any comments on the content or quality of the presentation?

7. Putting it all together for the 2019 cropping season: *Simon Craig*

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

Your next steps

8. Please describe at least one new strategy you will undertake as a result of attending this Update event

9. What are the first steps you will take?
e.g. seek further information from a presenter, consider a new resource, talk to my network, start a trial in my business

Your feedback on the Update

10. This Update has increased my awareness and knowledge of the latest in grains research

Strongly agree	Agree	Neither agree nor Disagree	Disagree	Strongly disagree
❑	❑	❑	❑	❑

11. Overall, how did the Update event meet your expectations?

Very much exceeded	Exceeded	Met	Partially met	Did not meet
❑	❑	❑	❑	❑

Comments

12. Do you have any comments or suggestions to improve the GRDC Update events?

13. Are there any subjects you would like covered in the next Update?

Thank you for your feedback.